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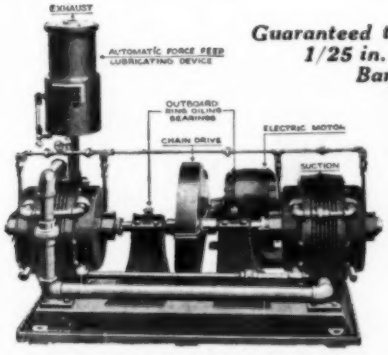

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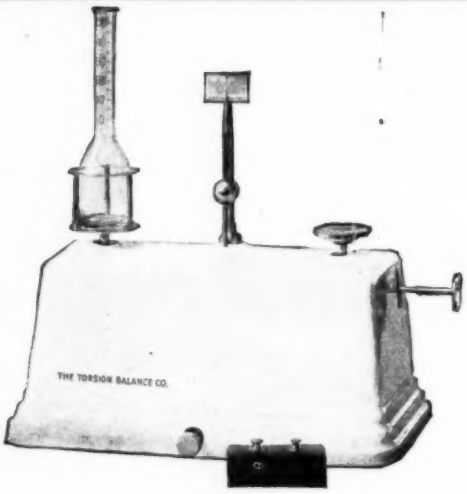

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VOLUME V | FEBRUARY, 1928 | NUMBER 2

CONTENTS

The Fish Oil Industries (Part 1)
By F. H. Meisnest 33

Purification and Deodorization by Absorptive Carbons,
By John P. Harris and Bernard N. Glick 46

The Pacific Coast Oil Industry (Part 2),
By P. W. Tompkins 48

American Oil Chemists' Society,
Notes and Correspondence 58

Fourth Quarter Census Report 60

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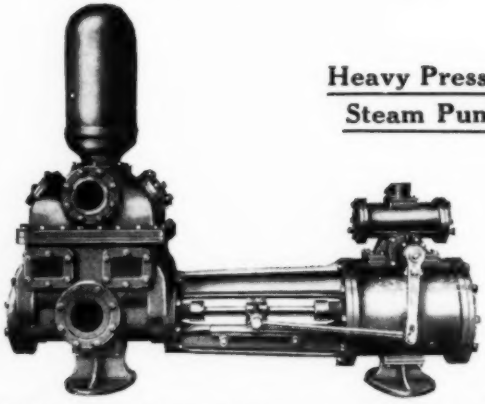

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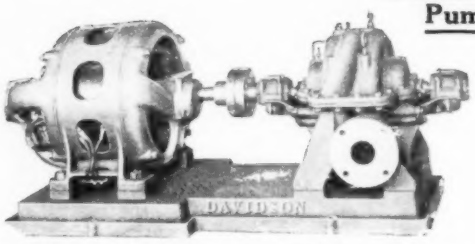

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Courtesy Canadian Pacific

Sealing schooners at anchor in harbor of St. John, New Brunswick

The Fish Oil Industries

Describing the Production and Utilization of Fish and Marine Animal Oils

BY FREDERICK H. MEISNEST

FISH oils and Marine Animal oils are important because they are relatively cheap oils, and so find a readier market than the higher priced oils and fats. In the United States they constitute 6% of the supply of inedible oils. The domestic production of fish oils, including whale oil, averages about 100 million pounds.

I have separated the oils into two

groups, or classes;—one group I call non-competitive oils,—sperm, seal, cod, and cod liver oils. These oils are used for special purposes and do not compete with the other fish and whale oils. I have called the other group intra-competitive oils for they can be substituted for one another and for certain animal and vegetable oils and fats under varying conditions. We will first consider briefly the non-competitive oils, and then take up the more important intra-competitive oils.

Non-competitive Oils

Sperm oil—There is no separate fishery conducted now for sperm whaling. They are taken only incidentally to the capture of the other species of whales. Sperm oil, made from the sperm whale, is a liquid wax that is not classified as a fatty oil as are fish, fish liver, and whale oils. Although this species is not extinct they have been hunted and harassed until now sperm oil is a by-product of the whale industry. Other oils, namely, the hydrocarbon oils, have been substituted for sperm oil and have practically driven it off the market.

Sperm whales are hunted in much the same manner as the ordinary whale which I will discuss later. Norway is the World's largest producer of sperm oil.

Sperm oil is produced from the head cavity and from the blubber of

Ewing Galloway

Seal rookeries at Ketavie, Alaska

the sperm whale. The head and body oils are usually mixed. The chief operation of refining is the separation of the spermaceti from the oil. This is effected by prolonged refrigeration and subsequent pressing of the partially solidified mass. The clear oil obtained in this manner is known as *winter sperm oil*. It is bleached through infusorial earth before it is marketed. *Spring sperm oil* is produced by a similar treatment of winter sperm oil at a higher temperature. The spermaceti solidifies from a third pressing at about 90 to 95 degrees F. This is refined by melting and boiling with a dilute caustic soda solution. It is washed with water and run into molds to permit crystallization. Refined spermaceti is a white, lustrous, translucent, crystalline substance. It is tasteless, colorless, and can be rubbed into powder with the fingers. Our wives find spermaceti in their lipsticks, cold creams, and other cosmetics. It may also be used for candles. Sperm oil is used for lubricating light rapid-running machinery such as spindles of cotton and woolen mills.

Seal oil—Seal oil, made from the blubber of several species of seals, is produced in Norway, Canada, and Newfoundland. In Alaska we have a herd of seven hundred and fifty thousand but these are fur seals and are protected by international treaties. Newfoundland, the world's largest producing country manufactured about one million gallons of seal oil in 1925, which they exported mainly to the United States, although some went to the United Kingdom. This industry has been described as the world's greatest hunt, by George Allan England, because the men endure unlimited hardships during the open season from March 15 to May 1. The sealers cruise northward from Newfoundland into the ice fields off Labrador and Greenland seeking the seals that live on the ice. The crew of a steamer consists of 150 men, who risk their lives to share about $5,000.00 for the six weeks' period. The highest share any hunter ever received is $167.00 while some have gotten only $7.00.

When the captain locates a herd of seal, the hunters armed with clubs and guns crawl over the side of the boat and jump from one cake of ice to another until they get onto the large body of ice where the seals are. The seals are clubbed or shot and dragged back to the ship by the hunters. Skinners remove the skin and blubber and store them in the hold. The boats return to port at the end of the season or when they have secured a full cargo. Each boat tries to get about twenty thousand seals a trip.

There are several methods of rendering the oil. By direct steam is the most common method. Under this method the blubber is put into large tanks and steamed and the oil skimmed off. Several grades of oil are made by this method, according to color. The first oil removed is the finest and lightest in color. The decadence of the seal industry has been gradual and unless the seals are further protected by law the supply will decrease. Other oils are being substituted for seal oil so it does not command the price it used to.

The best qualities of seal oil are used as illuminants in lighthouses. It has been used as an adulterant of cod liver oil, but of course there is no official record of this. Cheap fish oil has sometimes been mixed

with seal oil and the mixture sold as seal oil. Small quantities of the oil are used in currying leather. The cheaper grades are used in the manufacture of soaps, particularly soft soaps.

Cod and cod liver oil—Cod liver oil is prepared from the fresh livers and is intended for medicinal purposes while cod oil is prepared from decomposed livers and is intended for industrial purposes. The world production of cod and cod liver oil approximates eight million gallons a year. Norway is the largest producer, with Newfoundland a close second. The United States manufactures 2 per cent of the world production. It is all produced on the Atlantic Coast, principally by pharmaceutical houses. No cod liver oil is produced in Alaska, because the cod livers are too small. Even on the Atlantic Coast only 3½ per cent of the fisherman's gross revenue is derived from the sale of cod livers.

In the early days of the industry the oil was produced by letting the cod livers rot in a barrel until the oil floated to the surface and was skimmed off.

The direct steam process is used almost entirely now. Last August through the courtesy of Dr. Arthur D. Holmes, of the E. L. Patch Co., I had the pleasure of going out on one of the boats operating out of Boston. They have their own representative on the boat who manufactures the oil. They have these representatives on 29 other trawlers in the United States. These men secure the livers as the men dress the fish, and put them into tanks that hold about two barrels. It is cooked by live steam and as the oil rises to the top it is skimmed off, filtered, and run into barrels for shipment to the refining plant in Gloucester, Massachusetts. They blend the domestic and Newfoundland oil in large tanks to secure a uniform product. This mixture is chilled and pressed. The stearin solidifies and is sold for soap making. The oil is pumped to storage tanks where a flavor is added to give it a more pleasant taste. From this tank it is forced into a small pipe which carries it to the bottling machine. The bottles are filled and sealed automatically. This plant at Gloucester is the cleanest fish plant I have ever seen.

Cod Oil is produced because many small boats are engaged in the fishing industry that cannot carry the cod liver oil equipment. It is prepared from decomposed livers in much the same manner as cod liver oil is produced. Large quantities of cod oil are used in the leather trade. In Europe they hydrogenate large quantities of cod oil for margarines. The principal use is for soap.

Intra-competitive Oils

In the intra-competitive oils I have classified whale, menhaden sardine, pilchard, herring, and salmon oils. In the United States these fish and marine animal oils compete not only with each other but with certain inedible animal fats and oils, such as tallow and grease. In Europe these fish oils and whale oil compete with certain edible oils and fats as well as with the inedible. There is no foreign competition with respect to menhaden oil since it is made from fish found only off the Eastern shore of the United States. Nevertheless, the similarity between menhaden oil and, for instance, whale oil, and the uses they both serve leads to competition.

The degree of interchangeability

depends upon a number of factors with which the reader is probably familiar. The principal ones are the physical and chemical characteristics, composition, and the price factor. In the manufacture of soap, if fish oils are available at a lower price than tallow or other inedible oils or fats, it may be substituted for the higher priced fat or oil, but this interchangeability may be limited by standards regarding substitution in certain grades of soap, and unless his plant is equipped with a hydrogenation plant the soap manufacturer is not in a position to use fish oil or whale oil regardless of the price advantage. In certain classes of soaps this substitution may constitute as high as 50 per cent. I do not mean that all animal or vegetable oils are equally suitable for every purpose or that interchangeability means complete substitution of one oil for another. Complete substitution may occur but substitution generally means a change in the relative proportions of the constituents. Even the slight difference of ⅛ cent a pound on the market price may cause substitution of one oil for another. This substitution permits economic competition between fish oils and marine animal oils and certain vegetable oils and fats.

Grading, sorting and cleaning cod fish on deck of steam trawler

The approximate annual world production of the intra-competitive fish and whale oils is about three-quarters of a billion pounds. Norway, the largest producing country, manufactures about 38 per cent of the world's supply, the United Kingdom 19 per cent, the United

Ewing Galloway

General view of a British Columbia whaling station

States 14 per cent, and Japan 6 per cent.

In the domestic production of these intra-competitive oils more menhaden oil has been produced during the past twenty-five years that of any of the other oils. The combined production of sardine and herring oil approximates the output of menhaden oil. Whale oil, once the leading oil, now ranks fourth. In 1926, the combined production of the intra-competitive oils was eighty million pounds in the United States.

The United States imports of the intra-competitive oils have quadrupled since 1921 because of increased imports of whale oil. It constitutes 84 per cent of the imports of these oils. Pilchard oil imported from Canada constitutes the bulk of the remaining imports. Herring oil and sardine oil imports have increased since the world war. They come principally from Japan.

The exports of the intra-competitive oils are small, constituting 1 per cent of the domestic production.

Processes

There are two processes of rending fish oils which are known as (1) wet rending, and (2)dry rending. The wet rending method uses steam to cook the fish and extracts the oil by pressure. The various plants of this type on the market are known as the "continuous" reduction plants, and the "batch" type. The dry rending method removes the moisture from the fish, often by a vacuum process, and extracts the oil by a solvent or by pressure. The solvent method is not used very extensively at the present time, but it is likely that in the future its efficiency will make

it more popular and its use will become more general.

Whaling

Whales are in many respects the most interesting and most wonderful of all living creatures. The United States was once the world's largest producer of whale products. During the golden era of whaling, 1815 to 1860, many fortunes were made in this industry and the American whaler hunted all of the oceans and seas for whales. The decline of the whaling industry in the United States is one of the outstanding features of the fisheries history of the world. The decline is attributed primarily to the Civil War which destroyed the fleet; the financial crisis of 1857 that caused many whaling companies to fail; the discovery of petroleum which led to substitution; and the invention of the harpoon gun which increased whaling efficiency and decreased the number of whales. Contributing factors were the discovery of gold in California which drew the adventurous whalers, and the uncertainty of financial return from the business.

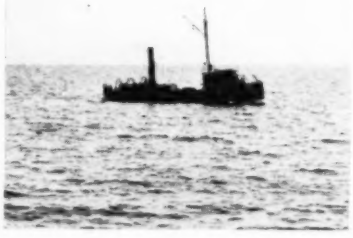
The domestic industry is pursued along the Pacific Coast and in Alaska. Small steamers about 100 feet in length, mounted with a harpoon gun, are used to capture the whale. At the shore stations in California, British Columbia, and Alaska, the whales are drawn into landing platforms where they are flensed; that is, the blubber cut off. The blubber varies from 6 to 12 inches in thickness. This

Ewing Galloway

Whale being hauled ashore at whaling station. Note two others in background

is rendered to produce the better grades of oil. The flesh is then removed and cooked to produce the cheaper grades of oil. Finally, the bones are cut into small pieces and dumped into boilers to make bone meal. The blubber is cooked by steam and pressed in hydraulic presses to obtain the oil.

The Norwegians have inaugurated a new system that eliminates the shore rendering station. They use a large ship of about ten thousand to fifteen thousand tons as a floating factory, and for each floating factory there are about five whaling boats. The operators of this invention haul the whale up on the deck through a trap cut in the bow or the stern of the floating factory. A winch is used to haul the whale up the incline and the trap door is closed. The whale is then rendered in the same manner as on the shore.



Typical steam trawler used for menhaden fishing

The Norwegians, British, and Argentine Companies use these ships to avoid payment of license fees and export duties, and to enable them to utilize the entire portion of the whale. The old whaling method allowed the boats to flense the whale alongside the factory and then cast the carcass adrift because they could not haul it aboard. Only one floating factory of this kind is used by the five companies on the Pacific coast.

The world production of whale oil approximates half a billion pounds annually, the bulk of which, 62 per cent, is produced by Norway and Great Britain in the Falkland Islands. The United States produces now only an insignificant amount, about 2 per cent of the world production. Since 1922 imports of whale oil into the United States have quadrupled in comparison to the previous 14 year period. Of the half billion pounds of whale oil produced the United States consumes about sixty million pounds and produces less than ten million. I understand that 95 per cent of the whale oil consumed in the United States is utilized in the manufacture of soap. Less than 2 per cent is used for edible purposes, according to my information. A different situation is to be found in Europe. They utilize large quantities for edible purposes. All the fish oil used in the United States is for soap, and so far as I can find out in Europe it is hydrogenated and used for margarines and lard substitutes. It is interesting to note that Holland and Denmark, large producers of butter, export the high priced butter and eat margarine.

Menhaden Oil

At the present time the center of the menhaden industry is in Reedville, Virginia, where over $5,000,000 is invested in equipment. I would not say however that the plants are the most up-to-date, since

a large number of them have not made any material change in their procedure of operation for 25 years. The expansion of the menhaden industry continued until in 1920 there were about 60 factories operating, which employed a fleet of 150 steamers and about 7,000 men.

With the fishing boats.—The fish are located by the captain and first mate who scan the waters from the top of the mast of the vessel. Then two purse seine boats, each carrying half the net, surround the school of fish and purse the net before the fish can escape. The steamer then comes along side and the fish are dipped into its hold.

The steamers leave their berths in the early morning, spend the day cruising and put back to their home factories or into the nearest harbor at dusk. They are limited in fishing range only by the necessity of discharging their cargo promptly so that the fish may be cooked before they deteriorate.

The transfer of the fish from the steamer's hold is accomplished by means of a bucket elevator into which the fish are fed and carried through a weighing device before discharge into cooking machines or storage bins.

Reduction.—The cooking is done in a long cylinder about two feet in diameter equipped with a screw conveyor that slowly forces the mass through the cylinder to which the heat is applied by means of steam jets in the bottom. This treatment breaks up the fish so that the oil will flow readily when the pressure is applied and the soft wet mass is then conveyed to the press, which consists of a tapered screw fixed on a hollow shaft, rotating inside of a similar and parallel shaft called the curb. The mass moves forward and is pressed by the decreasing size of the screw and curb.

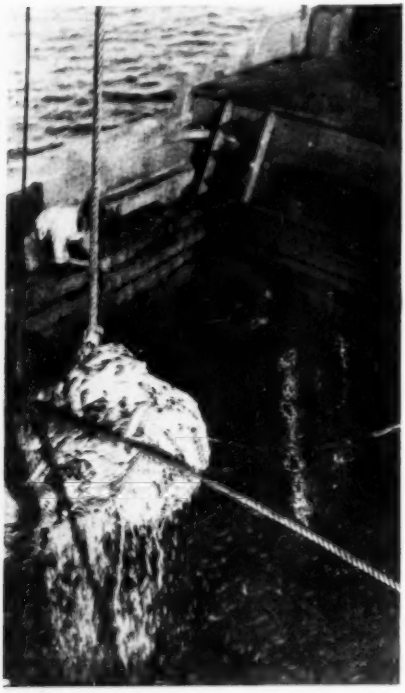
Oil and water are caught in concrete basins beneath the presses and carried to receiving tanks for further treatment while the remaining solid matter or scrap is deposited separately, dried or treated with acid and sold as meal or fertilizer. In each hundred pounds of material leaving the presses there are approximately four pounds of oil, forty-six pounds of water, and fifty pounds of scrap.

The separation of the oil from the water is accomplished by means of a series of open tanks each connected to take the overflow or skim-

Menhaden seine closed, ready for the haul

mings from the preceding tank in the series so that when the fluid has reached the last tank it is practically free from water. After separation has been accomplished the oil is heated to the boiling point for about 30 minutes, and then, after being allowed to stand for a day exposed to the sun, it is run into storage tanks and held ready for shipment to the refiner.

Both the quality and yield of the oil depend primarily on the quality of the fish, which varies with the locality in which the catch was made, the season of the year, and



Dipping menhaden aboard ship from the seine

the kind of a fishing year it may happen to be. The best oil is obtained from the large fat fish which are found usually in northern waters toward the end of the fishing season, and a yield of eight gallons of oil per thousand fish is a fair average. This figure may be exceeded under favorable conditions during the late summer. The quality of oil also depends on the skill of the workers at the factory and the promptness and thoroughness with which the cooking and pressing are accomplished.

The menhaden plants generally cover several acres and employ from 125 to 160 men. On the Pacific Coast less than one-half this number are employed per plant. They have the mistaken idea on the Atlantic Coast that their plants must be equipped to handle enormous catches of fish which must be handled immediately. It is my idea that if these plants were equipped to handle the average quantity of fish, they could operate steadily during the producing season, and during the slack periods they could catch up. Producers tell everyone that they must be equipped to handle a million and one-half fish a day, but it is only one day or possibly several days a season that such a catch occurs. They will, however, not make any changes that cost any money because their fathers made money under these methods, and they have made enough money at times to make them think the methods suitable for this day and age.

It is the custom at Reedville to cook and press the fish at night, after the steamers have returned with the catch. The next morning the pressed fish is shoveled into a conveyor and carried to the drier, which dries it to 8% moisture. The meal is then conveyed to the warehouse and dumped on the floor. Some plants, however, produce green scrap, and sell it as it comes from the press without further

treatment. This material contains 40% moisture. Some plants add sulphuric acid to this material to prevent it from decomposing too rapidly. Other plants just sell the dried material as scrap.

Typical menhaden oil and fertilizer factory at Reedville, Virginia. Note piles of fish meal

Even in the handling of the oil their process lacks efficiency. They allow the oil to stand out in open tanks, believing the sun's rays will help clarify it. Rain often damages it. Any chemist knows what water will do to oil, but it is difficult to convert the menhaden producers to new practices.

The domestic production of menhaden oil averages about forty million pounds, but the migratory habits of the fish cause the yearly production to vary considerably. Production of this oil, therefore, depends upon the abundance or scarcity of the fish, the weather conditions playing a considerable part in their migrations.

Crude and refined menhaden oil is used in the manufacture of soap, paint, linoleum, oilcloth, in tanning and in tempering steel. It is estimated that 40% of the production is used in soap, while the next largest use is for paint. I understand that all the menhaden oil used in soap is hydrogenated. Refined menhaden oil and sardine and herring oil are the best materials that can be used in the preparation of certain heat-resisting paints, that is, for surfaces that become hot, such as boilers and smoke-stacks, etc. According to experiments conducted, it does not make a good oil for white paint, and it is a strictly out-door paint. Large quantities of menhaden oil were formerly used in tempering steel, but this market has lost to lower priced oils. The future of the industry depends upon the perpetuation of the supply of fish and its ability to compete with the other intra-competitive oils.

Sardine Oil

Let us now make a transcontinental trip to the Pacific Coast and consider the various fish oils produced there.

Sardine Oil—The sardine reduction plants are similar to the ones used in the menhaden industry but have a smaller capacity, and I believe are more efficient. The meal and oil plants are all operated as an adjunct to the sardine cannery and not as a separate industry like the menhaden plants.

Tanks for separating fish oil from emulsions, fish oil and fertilizer plant

The canning process is almost a by-product oil now and the meal and oil the main products. In 1922 one packer I know lost $13,000 packing about 100,000 cases of sardines but made $30,000 from his reduction unit. The canners can probably make more money from the meal and oil than from canning sardines but the California law requires that 75% of the fish be canned. It has cost the packers a large amount of money to find out through the courts that this law is valid. The State has even confiscated several ships equipped as floating reduction units, so there are some that know the law is valid.

There are three important centers of the industry in California; namely:—Monterey, San Pedro and San Diego. I will describe the methods employed at Monterey, since they are typical of the industry, on the Pacific Coast.

The most profitable time for fishing is during the dark phases of the moon, since during full moon no fish at all can be caught. This sounds fishy, but the fishermen locate the schools of fish at night by the phosphorescent light produced by the movement of the fish in swimming. This explains the dependence of the fishermen upon absolute darkness, since it is almost impossible to see the fish in the water during full moon. A few fish are sometimes caught in the daytime by watching the gulls, as they feed upon the splashing fish.

Several hauls may be necessary to secure a load of fish, since water hauls are often made,—that is the fish swim down and out of the net, and all the fishermen have is a bag full of water.

On returning to port with a load, the boats unload the fish into me-

chanical elevators that convey them into storage bins in the cannery. Cutters remove the heads, entrails, and tails, which are sent to the reduction plant. The body portion is canned. A large percentage of the sardines are from 6 to 8 inches long and must be cut so they will fit the cans.

The most popular method in the reduction is erroneously known as the "continuous" machine or unit. It is in reality the wet rendering process. The plants have a capacity for from two to ten tons of fish per hour.

In order to secure the manufactured meal and oil it is necessary to cook, press, and dry the fish and separate the oil from the emulsion as it comes from the press. The raw fish are carried by an elevator into a continuous screw conveyor and steam is injected at various intervals so that the fish will be thoroughly cooked. The cookers used maintain a steam pressure of from 5 to 10 pounds, while those employed on the Atlantic coast cook the fish at atmospheric pressure. From the cooker the fish drop into a continuous press which is said to be a modification of the type used for pressing olives. The oil and water is pressed out as the auger shaped screw works in a metal jacket which is lined with a perforated screen. The emulsion then flows to settling tanks.

The pressed fish is dried in a direct heat rotary dryer. This material is ground and sacked and sold as fish meal for feeding poultry, cattle, hogs, and for fertilizer.

The gravity flotation method is employed in separating the emulsion. It is run into a series of tanks, generally four in number, of about 500 to 1,000 gallons each, and is allowed to overflow from one tank to the other. It is then cooked by means of steam coils in each tank, which maintain a constant temperature from 180 degrees to 210 degrees F. The superfluous water is drawn off the bottom of each tank to permit a continuous flow from one tank to the other. Almost pure oil will separate out in the fourth tank and it is then cooked in a fifth tank to get rid of as much water in the oil as possible. A great deal of care has to be exercised in cooking the oil so that it will not be overcooked, which would darken it.

(To be continued)

Atlantic

Menhaden fish meal fertilizer stock-pile

Purification and Deodorization By Absorptive Carbons

A Discussion of Modern Methods of Bleaching as Applied to Oils and Fats

By JOHN P. HARRIS AND BERNARD N. GLICK

IN the eternal striving for production with economy and the resultant habit of classifying everything he uses, the vegetable oil refinery superintendent or chemist has come to regard activated carbons as "bleaching agents," to be used particularly on oil running high in red. As a result of this, carbons are usually tested and evaluated purely on the basis of color comparisons just as in the case with fuller's earth and acid washed clays. While the bleaching power of a carbon is important, it is the property of these products most easily achieved by the manufacturer, and a decolorizing test fails entirely to establish other properties even more valuable, especially since most carbons on the market are practically equal in their bleaching power, irrespective of price.

The process of bleaching, which involves merely a reduction in color, can be accomplished by various means. Chemical methods are of course impossible in edible oil work and even physical methods, as exemplified in the earths and carbons, vary widely in their manner of bringing about the desired result. The main difference can be described briefly by noting that one class of agents act by changing the original coloring matters to products of lighter color, but leaving them still in the oil, whereas those of the other "class" absorb the coloring matters, which are then entirely removed from the body of the oil along with the carbon, in the subsequent filtering operation.

Absorptive Carbons Remove Impurities

As would be expected bleaching agents of the first type, mostly earths and clays, are apt to introduce a foreign flavor or odor into the oil and give a bleach that is not entirely permanent. Those of the other type, comprising the carbons, sweeten the oil, render the following deodorization easier and give a lasting bleach.

Even carbons differ largely in this absorptive power, depending on the raw material used and the methods used in activating. It is possible to get a dense carbon with practically all its activating power on the surface or a light porous product with immense power of absorption, and it is easy to see that this latter type of carbon would exert not only the maximum bleaching power, but also a very marked effect as regards extracting from the oil foreign matter, such as moisture or meal, traces of soaps, resins, phosphatides, etc.

Of course this removal of impurities is tremendously beneficial to any edible vegetable oil, be it in a refined or crude state, and it amply repays the user regardless of the item of decolorizing, which

seems of prime importance to those in charge of production.

Many operators wonder why certain refineries produce a premium quality product from year to year, when their equipment varies little from other refineries. It seems almost to them as if there is some touch of magic to the other fellow's operations. They instinctively think of some secret process. "They are doing something," is a stock phrase. The consistent success of these certain refineries is not due to secret processes but to a consistent, painstaking attention to details, and to a refusal to slight the smallest item which will give them a clean, pure oil.

Deodorizing Depends on Preparation of Oil

The finest deodorizing system in the world would be wasted upon a plant that did not consistently and painstakingly bend every effort towards bringing a clean, pure oil to be deodorized and finished, and no step, however small, can afford to be slighted in producing a refined and purified oil worthy of being deodorized.

It is a moot point as to whether a really properly cleansed and purified oil can be produced for deodorization without the use of a purely absorptive activated carbon, but everyone who has tried it will admit that the use of such a carbon will greatly assist in producing a perfectly clean and purified oil.

Decolorizing by means of such a purely absorptive carbon brings about a stability of color not to be expected when using other kinds of bleaching materials. For, obviously, there will be no reversion of color in a perfectly purified oil, such as may take place in subsequent processing in case of an imperfectly treated oil, one, for instance, which still contains traces of soluble soap, phosphatides, resins, or other impurities even in very small amounts.

The treating time is substantially reduced in case of deodorizing a perfectly purified oil, but more important is the fact that no amount of treating in the deodorizer will produce satisfactory, lasting results in an imperfectly cleansed and purified oil.

Those of us who are familiar with the absorptive power of properly activated carbon upon lachrymatory and other forms of toxic gases, are not surprised at its remarkable absorption of odors. As a preparation for the deodorizing equipment it is unsurpassed.

In case of glycerine, gelatine and even strong smelling glues, it produces a very remarkable neutrality of flavor and odor.

Outstanding operators realize that the use of a purely absorptive carbon is a tangible asset in effecting a whitening and brightening not otherwise to be secured. But it is an even more important asset in the more intangible purification which leads to the production of "absolute" quality.

OIL CHEMISTS

Make your hotel reservations early for the A. O. C. S. Convention

New Orleans, La., May 14 and 15, 1928

The Pacific Coast Oil Industry

History, Evolution and Progress of the Vegetable and Fish Oil Trades

BY P. W. TOMPKINS

Continued from January Issue

Varieties of Oils Imported

A brief sketch follows of various oils imported on the Pacific Coast. It is not intended to cover the entire field, but merely the better known and those which have come most to our attention.

COCOANUT OIL was one of the first oils of any importance to be imported to the Pacific Coast, coming in the early nineties. Supplies arrived from Australia in very poor containers, representing old wine, olive oil and beer barrels, while those from Ceylon, via Hongkong, were packed in hogsheads and puncheons, and arrived in extremely poor condition with heavy leakage.

The supplies of cocoanut oil from Australia and Ceylon increased gradually with more modern packages being used, up to the beginning of the World War, when the Pacific Coast ports were the chief points of entry for Oriental products. During this period tremendous quantities of cocoanut oil were imported from Australia packed in modern second-hand barrels; from Java and Celebes packed in second-hand kerosene oil tins and later in new American barrels; from Indo-China packed in second-hand kerosene oil tins; from Japan packed in second-hand kerosene oil tins and in American barrels and from the Philippine Islands in barrels and drums, and also in bulk in steamers' deep tanks. One plant at San Francisco had storage capacity for cocoanut oil alone of considerably over 4,000,000 gallons (approximately 15,400 short tons), and these tanks were kept full most of the time.

During the period of these heavy imports, cocoanut oil was free of import duty, but with the passing of the import tariff of 1922, which assessed an import duty of 2 cents per pound, the imports from all countries other than the Philippine Islands ceased. At the present time large quantities of cocoanut oil are imported through Pacific Coast ports from the Philippine Islands in steamers' deep tanks, which is the cheapest and most efficient method of handling and transportation. The principal uses are for edible products and soap making, particularly "salt water" soap.

There are also several cocoanut oil crushing plants located in California and one in Oregon, and occasionally some of the cottonseed oil mills will crush copra in the off season.

CHINA WOOD (TUNG) OIL attracted the attention of San Francisco importers as far back as 1889, the first imports being brought over by sailing vessels about 1890 and 1891. At that time, it was packed in the original Chinese containers, that is baskets, paper lined on the inside. A combination of hogs' blood mixed with a certain quantity of chunam (otherwise known as shell lime),

made a very good and powerful adhesive which held the paper lining firmly, these shipments arriving in perfect condition and without leakage. Other containers represented the Chinese oil tubs, made of soft wood, without bilge and with a set-in cover, which tubs were stowed in the vessel in an upright position to prevent leakage.

Near view of one of many conveyors for moving and burning oil-soaked wooden cases

China wood oil was then sold locally on the coast as soap stock at about 2½ cents per pound, the importers at that time not knowing that wood oil was more valuable for other lines of industry, which was discovered later on.

Continued efforts to introduce wood oil for purposes other than soap making were eventually successful, creating a demand throughout the United States among paint and varnish manufacturers, primarily as a substitute for linseed oil. This increased the demand, as is reflected in the comparison of the original selling price of about 2½ cents per pound with the high of this year of about 30 cents per pound, and today China wood oil constitutes one of the leading foreign commodities imported through Pacific Coast ports. It is the base oil in many varnishes, and is often preferred to linseed oil for many purposes.

In 1910 one of the local importers established a cooperage shop in Shanghai, with about fifty Chinese coopers under the supervision of an American expert, with a view to introducing American made up-to-

date barrels. The firm in question shipped to China huge quantities of high grade American barrels knocked down. This undertaking revolutionized the transportation of wood oil to the United States. Previous to the introduction of the new American barrels, wood oil was shipped in second-hand made-over European barrels, which resulted in a tremendous loss through leakage. During the World War period, tins were also used, but now practically all shipments arrive in bulk in the deep tanks of steamers, though recently, owing to the unsettled state in China and holding of the tank barges on the Yangtze by the Chinese, considerable has been again arriving in drums and a little in barrels.

China wood oil paid an ad valorem duty of 25% as expressed oil up until 1897, when importers claimed that it should be free of import duty and under the classification of nut oil, nut oils being free of import duty. It was placed on the free list in 1903. The annual imports now amount to between 80,000 to 100,000 tons, the bulk of which passes through Pacific Coast ports.

COTTONSEED OIL from the Orient first appeared in San Francisco as far back as 1908, at which time the import duty was 8 cents per gallon. The oil brought forward was refined, but of a lower grade than the American Summer Yellow Cottonseed Oil. It was packed in new five gallon tins—two tins to the case—and originated in China. The Pacific Coast importers seeing an opportunity to develop a large business if the duty of 8 cents per gallon was removed, and the quality improved, set to work to have the commodity placed on the free list and were eventually successful, which resulted in a very rapid increase in imports.

Shortly after the removal of the 8 cents per gallon duty on cottonseed oil came the Oriental crude cottonseed oil, which developed into an article of very large importation. Then shipments were always made in American new oak barrels and the commodity found its outlet on the Pacific Coast and as far east as the middle western states. A few shipments have arrived in bulk in steamers' tanks. The refined oil is used for edible purposes, but being unequal in quality, it does not compete much with the domestic product. The crude oil is used in soap making or is refined in this country for edible purposes.

Fluorescence in the refined oil was always present, and is characteristic of the Oriental product as well as of the oil from the Indian cottonseed.*

In 1910 heavy shipments of the refined oil began to come forward in new American oak barrels and the quality gradually improved, thus permitting large quantities to be sold on the Pacific slope annually. Imports of Oriental cottonseed oil steadily increased until the passing of the Tariff of 1922, when an import duty of 3 cents per pound was placed on this product, acting as en embargo and practically terminating all imports of both crude and refined cottonseed oil.

The domestic production of cottonseed oil on this coast is developing steadily in connection with the cotton industry in California and Arizona. According to a survey made by the research department of the California Development Association in 1926, there were 16 cottonseed mills operating in California and 7 in Arizona. About 400 tank cars of cottonseed oil are produced in California annually,

which is principally consumed locally in the manufacture of shortening, also as salad oil, a small portion as cooking oil, and some in soap manufacture.

SOYA BEAN OIL importation originated on the Pacific Coast, commencing about 1908 and arriving in second-hand kerosene tins. At that time the oil was dutiable and the importers, seeing a large business opportunity if the duty was removed, were successful in having it placed on the free list. as 1910 started to ship it in tank cars across the American continent, which necessitated the installation of tanking facilities in San Francisco. This method of transportation was most economical, as well as being more satisfactory to the consuming trade. With the European war, the imports of soya bean oil showed an enormous increase, shipments then being brought forward not only in new American oak barrels, but also in tins, as well as in bulk in the deep tanks of steamers.

Bales of flattened coal oil tins, representing millions of cans ready for return to the Orient

The early shipments of soya bean oil, packed in tins and cases, were sold to soap manufacturers.

With the removal of the duty in 1909, the imports increased rapidly and the packing changed from tins to new American oak barrels. This oil found a ready market throughout the United States, and the Pacific Coast importers as far back These heavy arrivals continued until the tariff of 1922, which removed soya bean oil from the free list and placed it on the dutiable list at the rate of 2½ cents per pound, thus reducing imports tremendously.

Soya bean oil continues to be an article of import but only spasmodically. All shipments now come forward in bulk in steamers' deep

tanks in quantities of approximately 500 to 800 tons at one time. Some of this oil is consumed in this country, while a large portion finds its way into Canada.

Some of the early arrivals of soya bean oil originated at Shanghai, Hankow, Newchang and Dalny (Dairen), but the Manchurian product shipped from Dairen constitutes the entire present import. Most of the oil is pressed, and is consumed by the soap industry, though some is used

Many thousands of bean oil barrels as far as eye can see at Dairen, awaiting shipment to the Pacific Coast—September, 1917

in the manufacture of paint. During the World War considerable was used for edible purposes, and at present when the price of cottonseed oil is high enough to more than offset the duty on soya bean oil, the latter is imported for edible purposes as a substitute for the former. However, it is not as satisfactory as some other oils for such use owing to the difficulty of properly refining it for edible use.

PEANUT OIL, as already mentioned, was the first Oriental oil to be imported on the Pacific Coast, and until the World War was brought in chiefly for Chinese consumption and was packed in 18-lb. tins, as it still is for that trade. During the war period, as with most other Oriental oils, they began shipping it in second-hand five-gallon cans, as well as in barrels and drums, and later a little in bulk. Imports continued until the Tariff of 1922 went into effect, when a duty of 4 cents was imposed, which stopped all but occasional shipments to this country, although considerable still enters Pacific Coast ports in bond for Canada, and is carried in bulk in ships' deep tanks.

PERILLA OIL is another of the Pacific Coast initiates. When first brought forward it was known as

soozoo oil, also egoma oil, and later took its proper name of perilla. The first shipments about 12 or 15 years ago, were cold pressed oil of an extremely light golden straw color, originating in the Orient. Duty on the early shipments was assessed at the rate of 25% ad valorem as an oil expressed from seeds, but it later was discovered by a San Francisco importer to be produced technically from a nut, and in 1916 was placed on the free list as a nut oil.

Shipments of perilla oil since the removal of the duty have increased, but the oil coming forward now is hot pressed and slightly darker in color. There are two qualities imported now—one known as FAQ (fair average quality) of the season, with no guarantee as to the breaking point and the other guaranteed not to break below 600 degrees Fahrenheit. Until recently perilla oil was always packed in good second-hand barrels, but of late importers are getting away from the use of barrels and are bringing it forward in about 500-ton lots in steamers' deep tanks, this being the most economical method of transportation. The oil upon arrival is pumped into storage tanks for distribution or directly into tank cars for transcontinental transportation. It is used in the manufacture of paints, varnishes, enamels and printers' ink.

LINSEED OIL first became an article of import on the Pacific Coast after the beginning of the World War, during which period fairly large quantities arrived in second-hand tins, also in new and second-hand barrels; the importations being practically all consumed by the paint and varnish industry on the Pacific Coast. Since the war, imports from the Orient have discontinued, while spasmodic imports have been made from England and the Continent, arriving in bulk in deep tanks of steamers in quantities of 500 to 800 tons. Bulk shipments have also been received from the Atlantic Coast.

There is some linseed oil produced for local consumption around San Francisco Bay from linseed imported from the Argentine.

PALM OIL became an article of import to San Francisco in the early nineties but in rather small quantities until fairly recently, being used by soap and candle manufacturers, also for compounding lubricants and in the tin plate industry. The only grade brought forward was the Lagos (Africa) palm oil, which arrived in hogsheads containing about 825 lbs. each. Such shipments usually came to this country via Liverpool.

Sumatra (D. E. I.) palm oil first made its appearance on this coast about a year ago, being packed in new and second-hand American barrels. Recently some bulk shipments have been arriving by direct steamers from country of origin, being shipped in steamers' deep tanks of a capacity of about 500 to 900 tons, and arriving in perfect condition.

Sumatra palm oil is much lower in fatty acids than the Lagos product, due to more scientific methods of production, and is being used to an increasingly large extent in the manufacture of food products.

HEMPSEED OIL from Manchuria and Japan was another oil which was imported in second-hand tins. The first arrivals appeared about 1910 and imports were only spasmodic until the time of the World War, when large quantities were imported packed in the same manner, and shipped from here in tank cars to overland points to be

used in the manufacture of paints, linoleums and some for special soap purposes. This oil would still be an article of import were it not for the duty of 1½ cents per pound which makes its importation prohibitive at the present time.

SESAME OIL was not imported to the Pacific Coast in any quantity until the period of the World War, when large amounts were brought forward from China in second-hand tins, as well as in barrels. This oil not only found a large consumption on the Pacific Coast, but was dumped into tank cars and shipped throughout the United States. Refined sesame oil makes one of the finest of edible oils, being preferred to olive oil in some quarters, but has never been popular in the United States in proportion to its merits. The grade of oil usually imported here was the crude and only suitable for industrial purposes, such as soap making, although some refined oil was used by the fish packers.

RAPESEED (COLZA) OIL has been an article of import with local import merchants for many years, but in limited amounts, except during the period of the World War, when huge quantities were imported in both tins and barrels and later dumped into tank cars for transcontinental transportation. The first imports date back to the early nineties, and the refined oil still continues to be an article of import, but to a limited extent. It originates in Manchuria and Japan, and is used principally after being blown in making certain heavy lubricating compounds.

CANDLE NUT or *LUMBANG OIL* came into prominence on the Pacific Coast during the World War, at which time several thousand barrels were brought forward. The oil found a ready outlet locally and was also shipped throughout the United States in tank cars, and used in the paint, linoleum and varnish trades, likewise in some kinds of soap. It belongs to the same family as China wood oil, but comes from the Philippines. Because of the low price of linseed oil, for which it was a substitute, none has been imported for the last three years, and the nuts are no longer gathered.

CHINESE VEGETABLE TALLOW did not attract the attention of the Pacific Coast until the World War when it became an article of importation and it continues today to be a commodity of importance for soap manufacture and candle making on the Pacific Coast and elsewhere.

TEA SEED OIL from China, which was introduced by Pacific Coast importers, has been a spasmodic article of import since about 1910. The early shipments arrived packed in tins while the more recent shipments came forward in new American oak barrels. A 25% ad valorem duty keeps the importation of this oil down to a few tons yearly.

CHRYSALIS OIL, which is produced in Japan from the silk worm, claims San Francisco as its American birthplace. The first shipments arrived in 1910. The oil was packed in second-hand kerosene tins and was only suitable as a soap stock. For quite some years many thousands of cases of this oil were consumed on the Pacific Coast, the demand being much greater than the supply. Later on, experimental shipments were made to Germany, where it was found that the oil had certain qualifications which enabled the German buyers to pay more in the primary market than

could Pacific Coast importers. This eventually diverted practically all the supply of chrysalis oil to the German market, cutting off shipments to the Pacific Coast. In Germany this oil was refined and, if we are correctly informed, found its way into the silk industry.

LOOFAH OIL was never an article of large importation. It came from Japan and was used in the manufacture of soap. The first shipments in tins and cases appeared on the Pacific Coast about 1910 and only spasmodic shipments of 500 to 1,000 cases at a time were imported, which discontinued on account of the oil not being in favor for industrial purposes.

BEBE (INUKAYA) OIL appeared on the Pacific Coast about 1910, but only in a very small way, as the quantity available in the producing center (Japan) was so limited that it was not attractive to the importers. The small shipments that did arrive were packed in second-hand five-gallon tins and went into the soap kettle.

COQUITO and *COHUNE* (also termed *COROZA*) *OIL*—in former years spasmodic shipments found their way from Mexico to San Francisco. The oil being very similiar to cocoanut oil, readily went to the soap kettle. Sometimes it arrived packed in tins, sometimes in barrels and iron drums. Since unsettled conditions in Mexico, imports have been practically nil.

One of the difficulties in obtaining this oil in paying quantities was the removal of the thick husk and shell from the kernel, which formerly and to a considerable extent now, is done by hand by the natives until enough meat is collected for shipment or local crushing. Numerous machines and methods have been devised for this purpose, but most of them are only partly satisfactory owing to the extreme hardness of the shell. One firm has been successful in perfecting a combined husking and cracking machine which first husks the nuts and then separates the kernels from the shells in a very satisfactory manner. A plant is being erected in Honduras where there is an abundant supply of nuts, and through their ability to handle quite a large tonnage, it is anticipated that considerable of this product should be available to Pacific Coast importers in the near future.

CASTOR OIL did not attract Pacific Coast operators to any extent until the period of the World War, during which time they imported large quantities from China, Japan and Manchuria, which found a ready market throughout the United States for rotary aeroplane engine lubrication, soap manufacture, etc., the best commercial grade being employed for aeroplanes. The oil arrived at ports of entry in both second-hand tins and in barrels, and after arrival was dumped into tank cars for transcontinental shipment. The rotary type of engine has practically been abandoned, therefore the demand has disappeared for this purpose.

KAPOK SEED OIL produced as a by-product of the kapoc fibre industry was shipped in small quantities during the World War from the Dutch East Indies in drums and cases and later a little from the Philippine Islands in barrels. It is consumed mostly by the soap industry and is very similar in properties to cottonseed oil.

WHALE OIL dates back to the early days when the American whaling industry was a very important factor on the Pacific Coast. In the early eighties there were about a score of vessels in the whaling

fleet, flying the American flag on Pacific waters, and by 1893 the number was nearly 50. Later on, the American whaling fleet decreased and then began the importation of Oriental whale oil in large quantities yearly, finding an outlet on the Pacific Coast, also being shipped in tank cars overland to supply the soap, leather, etc., industries. Importation of the oil continued until curtailed by high import duties, and in recent years local whaling has been resumed. Large quantities of No. 1 whale oil are used in this country for edible purposes after hydrogenation. There is one San Francisco company with two land stations in California as well as a floating factory and four killer boats, which produced about 250,000 gallons of oil last year. They have operated as far south as Mexico and north to the Alaskan waters. From Seattle another whaling company operates in northern waters, which is stated to have produced in 1926 about 1,000,000 gallons of whale oil. There are also Norwegian whalers operating off the coast of Mexico, but they are not permitted to whale in United States waters; their entire production, much of which is sold in Europe, is subject to export duty from Mexico and deliveries in the United States pay 6 cents per gallon duty. They also pay a concession fee to the Mexican Government.

SPERM OIL—the Japanese product represented quite a large article of import on this coast for several years for lubricating and other industrial purposes. The first shipments commenced to arrive about 1910, being packed in second-hand tins. Part of the oil was consumed locally and the balance dumped into tank cars and shipped to eastern points. The present high duty on this oil is practically stopping all imports, but a small amount is produced on this coast.

FISH OILS—for many years, probably commencing about 1910, fish oils, such as herring, shark and sardine, were imported from Japan for Pacific Coast consumption. The oils arrived in second-hand tins and cases, and have various industrial uses. The importations were not large until about the time of the World War, at which time Pacific Coast importers did an enormous business in these products, dumping the oil upon arrival into tank cars for shipment to various points throughout the United States. Importing of these fish oils has been practically stopped by the heavy import duties.

There is, however, a thriving fish oil industry on this coast; production of sardine oil began at Monterey, California, in about 1915, and there are now some ten plants operating there. There are eleven plants at San Pedro, California, where the industry started in about 1918. The oil is a by-product of fish canning, and its principal source is the trimmings from the packs. Five or six hundred tank cars are produced in California each year. Sardine oil is used in the paint and varnish industry and sometimes employed as a substitute for linseed oil, and some of the oil is refined, deodorized and hydrogenated locally for edible purposes.

Besides sardine oil about 400 tank cars of herring oil is produced annually in Alaska. This oil being very high grade a large portion is hardened (hydrogenated) and used for edible and soap products. Two years ago the Canadian Government opened Vancouver Island to the reduction of pilchards, which is really a variety of sardine, and the first season we understand about 50

tank cars of pilchard oil were shipped, while last year the production was about 250 cars. There are also numerous other fish oils, such as salmon, dog fish, tuna fish, etc., produced on this coast in smaller quantities, the oils frequently being mixtures depending on the fish caught and packed at the time.

COD LIVER OIL has assumed considerable importance in the last few years on account of the public attention to vitamins. It is high in vitamins A and D and a large quantity is fed to poultry. Virtually all imports are from Norway and come in 30-gallon tin-lined casks.

CITRONELLA OIL from Ceylon first made its appearance on the Pacific Coast about the year 1890, and was at that time and for several years afterward packed in old bottles. At the present time both Java and Ceylon contribute to the requirements of importers, the oil now being packed in iron drums of both 55- and 110-gallon capacity. It is used as a perfume in the manufacture of soap and is also very useful as a repellent for mosquitoes. It is a high and variably priced oil, the Java product, which is more choice, having sold at times in the past for considerably over a dollar a pound. The quantity imported, however, is rather small owing to the limited number of consumers on the Pacific Coast.

MOWRAH NUT OIL — during the early nineties several experimental shipments for soap making were made from Liverpool to the Pacific Coast, but this oil was not found to be competitive with other oils of similar character, though it is an important article of commerce in India where it orignates. It is used there for edible purposes as well as having various technical uses, and considerable quantities are shipped to Europe. Of later years there have been no importations on this coast.

Modern Pacific Coast cannery and fish oil plant with its own fishing fleet in foreground

The American Oil Chemists' Society

Notes and Correspondence

Dates of 1928 Meeting

Dear Fellow-members:

The Society meeting will be held in New Orleans, May 14th and 15th, at the Hotel Roosevelt. The date set thus far ahead, gives us plenty of time to arrange our plans, so that we can be there.

If any one has any suggestions regarding speakers or other items that should appear on the program, we will be glad to receive them.

We hope that every member will try and be there, and that the meeting will be very profitable.

Yours very truly,
H. P. TREVITHICK,
President.

TO THE MEMBERSHIP:

"Glasses to be standardized have been coming in very slowly, and we would call your attention to the fact that the Governing Board adopted a resolution, that Referee Certificate will be withheld, unless the applicant had a standardized set of glasses.

Will you please send in all red glasses from 1 to 6, sending them to Mr. A. W. Putland, Portsmouth Cotton Oil Refining Corporation, Portsmouth, Virginia.

While refiners, packers and crude oil mills are not covered by the Governing Board resolution, much confusion will result if their glasses and those of the Referee Chemists do not agree.

Please do what you can to help this work along. It is important.

J. C. P. HELM,
Secretary and Treasurer.

Standardization of Lovibond Glasses

Report for December, 1927

1. The determinations of spectral transmissions of the following red glasses from set B.S. 9940 have been repeated: 0.28 and 0.38. (Walker.)

2. The spectral transmissions of the following red glasses from set B.S. 9940 have been determined:—0.12, 0.32, 0.46, 0.54, 0.56, 0.64, 0.74, 0.88, 3.9, 4.7. (Walker.)

3. Standard values for the spectral transmissions of the following red glasses from set B.S. 9940 have been adopted:—0.12, 0.28, 0.32, 0.38, 0.46, 0.54, 0.56, 0.64, 0.74, 3.9, 4.7. (Gibson.)

4. Standard equivalents on the additive scale of Priest and Gibson have been computed for the following red glasses from set B.S. 9940:—0.28, 0.32, 0.38, 0.46, 0.54, 0.56, 0.64, 0.74. (Gibson and Riley.)

5. Tests of the additivity of the numerals assigned by Priest and Gibson have been continued with the Aron's chromoscope. Experiments on grading the red glasses by means of the chromoscope have also been continued. A memorandum report on this subject is being prepared and this work is being laid aside at least for the present. The method has several features to recommend it but does not seem entirely reliable unless used in a way which requires so many observations as to make its use almost prohibitive economically.

Our present opinion is that probably routine testing can be better done by direct comparison with standards by means of the Martens photometer. (Priest, Walker, Judd.)

6. The search for red glasses in set B.S. 9940 having numerals accurately 0.100, 0.200, 0.300, 0.400, 0.500, 0.600, 0.700, 0.800, and 0.900 and also for exact units, has up to date resulted in finding the following approximations to the desired numerals:

Desired Numeral	Maker's Mark on Glass Selected as Closest to Desired	Computed Numeral	Computed Numeral Minus Desired Numeral
0.100	0.02	0.104	+0.004
0.200	0.11	0.185	— .015
0.300	0.18	0.296	— .004
0.400	0.28	0.365	— .035
0.500	0.38	0.495	— .005
0.600	0.46	0.593	— .007
0.700	0.56	0.711	+ .011
0.800	0.64	0.806	+ .006
0.900	0.74	0.900	.000
1.00	0.88	0.984	— .016
2.00	1.8	1.95	— .05
3.00	2.8	2.99	— .01
4.00	3.9	3.94	— .06
5.00	4.7	4.89	— .11
6.00	5.6	6.16	+ .16
7.00	6.8	6.85	— .15
8.00	7.8	7.90	— .10
9.00	9.0	9.17	+ .17
10.00	9.8	10.00	.00
11.00	10.8	....	.....

It will be noticed that in all but three cases for the fractional numerals, the departure of computed numerals from the desired numerals is less than 0.01. In the case of 0.200 and 0.700, it is still possible that we may be able to find glasses giving closer approximations to the desired exact tenths. In the case of 0.400 this possibility does not remain in so far as the set B.S. 9940 is concerned. Further study is being given to the selection of exact integers. (Gibson, Priest, Judd, Walker, Riley.)

7. The following reports have been submitted to the editor of OIL AND FAT INDUSTRIES (the official journal of the American Oil Chemists' Society) for publication:

(1) Judd and Walker: "A Study of 129 Lovibond Red Glasses with respect to the Reliability of their Nominal Grades."

(2) Priest: "Tests of the Color Sense of Members of the American Oil Chemists' Society and Data on Sensibility to Change in Lovibond Red at 35 Yellow 7.6 Red on the Lovibond Scale."

8. The following jobs were partly done at the close of the month:

(1) Measurements of the relative white light transmissions of the red glasses of B.S. 9940 in combination with 35 yellow. These ratios are being measured in order to test the consistency of sunlight transmissions already computed from the spectral transmissions of these glasses. The red glasses are compared in the Martens photometer with 35 yellow over the ocular. In the given series of glasses the transmission of each glass *relative* to its nearest neighbor is being measured. (Judd, Walker, Priest.)

(2) The white light transmission of each of the 35 yellow glasses submitted August 4th relative to 35 yellow B.S. 10289B is being measured by means of the Martens photometer. (Judd, Priest.)

IRWIN G. PRIEST,
Chief, Colorimetry Section.

Fourth Quarter Census Report

THE Department of Commerce announces that the factory production of fats and oils (exclusive of refined oil and derivatives) during the three-month period ended December 31, 1927, was as follows: Vegetable oils, 1,072,711,413 pounds; fish oils, 20,511,635 pounds; animal fats, 488,056,396 pounds; and greases, 89,709,275 pounds; a total of 1,670,988,710 pounds. Of the several kinds of fats and oils covered by this inquiry, the greatest production, 712,126,785 pounds appears for cottonseed oil. Next in order is lard with 381,371,605 pounds; linseed oil with 233,046,103 pounds; tallow with 104,581,274 pounds; coconut oil with 72,447,810 pounds; and corn oil with 31,991,776 lbs.

The production of refined oils during the period was as follows: Cottonseed, 576,615,063 pounds; coconut, 73,169,412 pounds; peanut, 3,508,883 pounds; corn, 28,902,550 pounds; soya-bean, 1,934,261 pounds; and palm-kernel, 4,302,176 pounds. The quantity of crude oil used in the production of each of these refined oils is included in the figures of crude consumed.

The data for the factory production, factory consumption, imports, exports, and factory and warehouse stocks of fats and oils and for the raw materials used in the production of vegetable oils for the three-month period appear in the following statements:

PRODUCTION, CONSUMPTION AND STOCKS OF FATS AND OILS

(In some cases, where products were made by a continuous process, the intermediate products were not reported)

Kind	Factory operations for the quarter ended Dec. 31, 1927 Production (pounds)	Consumption (pounds)	Factory and Warehouse stocks Dec. 31, 1927 (pounds)
Vegetables Oils:			
Cottonseed, crude	712,126,785	620,006,209	157,577,576
Cottonseed, refined	576,615,063	251,804,992	502,900,676
Peanut, virgin and crude	5,143,677	4,186,892	1,598,106
Peanut, refined	3,508,883	2,978,977	1,371,709
Coconut, or copra, crude	72,447,810	133,912,428	99,544,037
Coconut, or copra, refined	73,169,412	69,590,011	15,491,270
Corn, crude	31,991,776	34,719,639	14,060,083
Corn, refined	28,902,550	5,083,804	10,367,833
Soya-bean, crude	1,163,899	3,399,015	4,667,718
Soya-bean, refined	1,934,261	758,223	1,494,034
Olive, edible	492,630	646,564	4,806,199
Olive, inedible	7,575	1,360,388	992,949
Sulphur oil, or olive foots	.....	9,186,791	6,122,443
Palm-kernel, crude	.....	15,541,340	12,177,205
Palm-kernel, refined	4,302,176	2,470,107	2,130,033
Rapeseed	.....	4,388,323	5,716,541
Linseed	238,046,103	113,302,351	193,543,961
Chinese wood or tung	.....	20,094,824	17,580,827
Chinese vegetable tallow	.....	878,323	1,024,392
Castor	10,905,424	5,340,748	4,953,417

Kind	Factory operations for the quarter ended Dec. 31, 1927 Production (pounds)	Consumption (pounds)	Factory and Warehouse stocks Dec. 31, 1927 (pounds)
Palm	.....	33,972,199	41,153,599
All other	385,734	2,167,238	4,345,763
Fish Oils:[1]			
Cod and cod-liver	844,455	4,500,852	9,001,342
Menhaden	11,397,509	12,401,610	26,561,210
Whale	2,418,375	11,726,428	25,007,379
Herring, including sardine	5,509,822	9,310,161	22,363,093
Sperm	.....	208,757	2,391,383
Allother, including marine animal	341,474	6,509,583	10,515,489
Animal Fats:			
Lard, neutral	8,775,783	6,509,665	3,161,759
Lard, other edible	372,595,822	3,953,279	49,887,465
Tallow, edible	11,737,434	8,318,543	3,969,364
Tallow, inedible	92,843,840	143,506,313	76,996,822
Neat's-foot oil	2,103,517	1,482,468	1,509,829
Greases:			
White	15,688,351	6,936,538	5,270,013
Yellow	16,064,161	11,887,056	8,140,630
Brown	11,472,189	15,103,878	12,029,560
Bone	5,444,088	237,410	2,606,710
Tankage	13,564,403	237,634	3,987,101
Garbage or house	23,181,569	19,811,867	13,753,694
Wool	1,704,054	1,537,357	3,065,037
Recovered	630,727	706,857	1,008,137
All other	1,959,733	1,778,586	2,543,412
Other Products:			
Lard compounds and other lard substitutes	250,122,020	1,783,397	26,770,225
Hydrogenated oils	131,285,926	124,010,007	14,485,999
Stearin, vegetable	4,663,105	3,889,651	1,730,053
Stearin, animal, edible	15,915,540	10,526,289	5,891,258
Stearin, animal, inedible	2,222,401	2,800,567	3,649,483
Oleo oil	27,138,089	11,561,114	6,628,764
Lard oil	6,223,710	4,286,366	5,069,267
Tallow oil	3,754,688	1,931,910	1,869,234
Fatty acids	42,364,248	42,982,912	6,492,621
Fatty acids, distilled	12,041,013	10,106,497	3,369,544
Red oil	15,754,008	4,849,263	9,834,565
Stearic acid	11,302,923	3,600,068	3,678,336
Glycerin, crude 80% basis	31,489,319	34,610,814	18,266,458
Glycerin, dynamite	14,131,135	6,629,176	15,364,323
Glycerin, chemically pure	13,969,715	1,891,949	7,205,168
Cottonseed foots, 50% basis	77,212,325	71,159,778	46,355,323
Cottonseed foots, distilled	37,298,562	34,846,435	6,886,029
Other vegetable oil foots	19,377,366	18,530,280	3,776,815
Other vegetable oil foots, distilled	87,880	289,314	282,470
Acidulated soap stock	26,857,686	20,327,456	13,455,203
Miscellaneous soap stock	30,013	50,334	26,696

[1] The data of oils produced, consumed and on hand by fish oil producers and fish canners were collected by the Bureau of Fisheries

Raw Materials Used in the Manufacture of Vegetable Oils

Kind	Tons of 2,000 pounds Consumed Oct. 1 to Dec. 31	On hand Dec. 31	Kind	Tons of 2,000 pounds Consumed Oct. 1 to Dec. 31	On hand Dec. 31
Cottonseed	2,264,517	992,049	Flaxseed	355,617	257,024
Peanuts, hulled	4,780	695	Castor beans	12,435	4,143
Peanuts, in the hull	3,735	381	Mustard seed	361	1,210
Copra	55,132	24,853	Soya-beans	4,394	908
Cocoanuts and skins	2,359	352	Olives	1,557	88
Corn germs	54,051	178	Other kinds	558	26

Imports of Oil Seeds, Quarter Ended December 31, 1927

Kind	Tons	Kind	Tons
Cottonseed	51	Poppy seed	1,485
Castor beans	18,717	Perilla and sesame seed	32
Copra	68,642	Other oil seeds	2,422
Flaxseed	119,766		

Imports of Foreign Fats and Oils, Quarter Ended December 31, 1927

Kind	Pounds	Kind	Pounds
Whale oil	1,241,910	Palm oil	54,095,830
Cod and cod-liver	11,441,482	Palm-kernel oil	25,966,075
Other fish oils	27,908,730	Peanut oil	854,038
Animal fats and oils, edible	12,769,683	Rape oil	7,006,020
Wool grease	1,883,514	Linseed oil	105,942
Grease and oils, n. e. s. (value)	$105,003	Sesame oil	496,147
Chinese wood oil or nut oil	17,482,394	Soya-bean oil	2,245,075
Coconut oil	82,136,357	Vegetable tallow	1,218,779
Olive oil, edible	8,896,141	Vegetable wax	1,735,208
Sulphur oil, or olive foots	9,884,808	Other vegetable oils	1,417,134
Olive oil, denatured	2,043,487	Glycerin, crude	2,889,311
		Glycerin, refined	2,177,310

Exports of Foreign Fats and Oils, Quarter Ended December 31, 1927

Kind	Pounds	Kind	Pounds
Animal fats and oils, edible	1,200	Olive oil, edible	18,261
Fish oils	37,015	Palm and palm-kernel oil	1,229,201
Other animal oils, fats and greases	61,922	Peanut oil	796,492
Chinese wood oil or nut oil	1,685,197	Soya-bean oil	111,225
Coconut oil	1,068,928	Other vegetable oils	114,971
		Vegetable wax	212,031

Exports of Domestic Fats and Oils, Quarter Ended December 31, 1927

Kind	Pounds	Kind	Pounds
Oleo oil	14,167,071	Stearic acid	557,299
Neat's-foot oil	354,963	Other animal greases, oils	16,196,145
Other animal oils	180,960	Cocoanut oil	5,502,548
Fish oils	126,031	Cottonseed oil, crude	17,308,029
Oleo stock	1,664,188	Cottonseed oil, refined	2,269,418
Tallow	1,536,642	Linseed oil	708,966
Lard	162,846,106	Soya-bean oil	1,835,798
Lard, neutral	4,699,050	Corn oil	89,411
Lard, compound, animal	1,261,169	Vegetable compound	1,078,576
Oleo and lard stearin	992,624	Vegetable soap stock	3,085,002
Grease stearin	468,960	Other vegetable oils	3,609,994
Oleic acid or red oil	870,815	Glycerin	344,352